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# BIBLIOGRAPHY: STORAGE STABILITY OF SEMIPERISHABLE SUBSISTENCE ITEMS

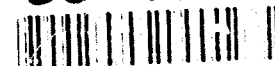
by  
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April 1993  
Final Report  
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# PREFACE

This bibliography was compiled under the work unit on Accelerated Testing, Project Number 1L162724AH99, Joint Services Food/Nutrition Technology, in the program entitled Food Stabilization and Shelf Life Indices for Military Feeding at Environmental Extremes. This program was undertaken in the Food Engineering Directorate (FED), Product Development Branch, Food Technology Division of the U.S. Army Natick Research, Development & Engineering Center (Natick). The work was performed under Aggregate Code MSR 1545, Program ID AD94-17, Cost Code 2315725BBOZOO, (AH99BBOZOO) during the period from 1 October 1991 to 1 October 1992. The authors wish to thank Mr. Curtis Blodgett and Ms. Patricia Prell (FED), and Mr. Robert Kluter (Soldier Science Directorate), and the staff at the Technical Library Branch for their assistance in this effort.

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## BIBLIOGRAPHY: STORAGE STABILITY OF SEMIPERISHABLE SUBSISTENCE ITEMS

### Background

The U.S. Department of Defense (DoD) requires rations and other subsistence items to be distributed, stored and used under constantly changing conditions in various environmental extremes. Storage and use of military rations may range from arctic to desert, from temperate climates to jungle locations. Rations must withstand temperatures below freezing, freeze/thaw cycles, temperatures in excess of 120°F, as well as physical abuse from rough handling and the potential for insect infestation.

The normal requirement for semiperishable military rations is that they remain serviceable and acceptable after storage for three years at 80°F. However, many ration components are stable for a longer period. This contrasts with industry practices whereby one year shelf life is considered long term and six months is more typical for the storage of semiperishable subsistence items. Operational rations are stored both in the continental U.S. and around the world in Prepositioned War Reserve Stocks (PWRS) in case of emergency situations. When, as is most often the case, no emergency arises, the rations are rotated out and used for training exercises. However, the amount needed for training purposes is usually less than the amount that should be rotated out.

Operation Desert Shield/Storm (ODS) reemphasized the need for the storage and use of military rations in desert situations. As a result, a program has been undertaken at the U.S. Army Natick Research, Development and Engineering Center (Natick) to address the problems associated with the storage and use of rations around the world, particularly in a high-heat environment. Entitled "Food Stabilization and Shelf Life Indices at Environmental Extremes," the program consists of eight work units. These include Accelerated Testing, Rapid Assessment Measurements, Food Preferences in High Heat, Measuring Heat Stability, Sensory/Analytical Measurements for Rations, Time-Temperature Indicators Correlation, and Nutritional Requirements and Bioavailability. Each work unit addresses an aspect of the development, evaluation, storage, and use of operational rations at environmental extremes.

The Product Development Branch, Food Technology Division of the Food Engineering Directorate at Natick addressed two of the above work units, Accelerated Testing and Rapid Assessment Methods, starting in Fiscal Year 1992. The purpose of the Accelerated Storage work unit is to study the correlation of storage stability of ration components using long term and accelerated storage conditions. With a mandated three year shelf life, any item under development must be stored for a minimum of three years to verify the shelf life, thus necessitating a development time in excess of three years. Although high temperature, shorter storage times are often used for preliminary shelf life testing, little data exist from structured research studies designed to correlate accelerated and long-term storage stability data.

The work unit on Rapid Assessment Methods is designed to establish a simple, rapid, and objective method to determine if a product in storage is acceptable, if it should be used in the near term, or if it should be discarded. In the military, veterinary officers inspect stored rations using statistical sampling (MIL-STD-105) and established guidelines for quality parameters. Although the highly trained inspectors are proficient in assessing food quality after storage, a rapid, definitive, chemical or physical test is preferable to human judgements. With rapid, objective quality determinations, the veterinary inspectors will have the capability to conduct more extensive surveillance inspections to ensure only wholesome rations reach the soldier.

#### Purpose

The purpose of this report is to publish a bibliography of references on storage stability related to the work units on Accelerated Storage Stability and Rapid Assessment Methods. The bibliography includes studies of the sensory, nutritional, chemical and physical properties and changes found in stored semiperishable food products. It includes procedures to measure quality, including both objective and sensory testing. Listed in the bibliography are books, technical reports, scientific papers, and other references pertaining to the shelf stability of foods and methods of measuring stored food items. Literature searches conducted through the Defense Technical Information Center are included. Because extensive long term and accelerated testing is being conducted on six ration items (applesauce, cheese spread, peanut butter, grape jelly, fig bars, escalloped potatoes with ham), particular attention was given to these products. The authors realize that a totally comprehensive list of all objective and sensory testing of stored food items is neither practical nor achievable. However, the data obtained should be of interest to all concerned with long term storage stability of foodstuffs.

## Organization of References

The references for this bibliography are listed alphabetically by reference type under the categories of books, technical reports, scientific papers, others, and literature searches. The literature searches were conducted by the Technical Library Branch, Information Management Directorate at Natick.



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